

# JONES DAY

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December 5, 2016

## VIA ELECTRONIC FILING

Marlene H. Dortch  
Secretary  
Federal Communications Commission  
445 12th Street S.W.  
Washington D.C. 20554

**Re: Oral *Ex Parte* Notice  
GN Docket No. 14-177, IB Docket Nos. 15-256 and 97-95;  
RM-11664 and 11773; WT Docket No. 10-112 and  
IBFS File No. SAT-LOA-20161115-00109**

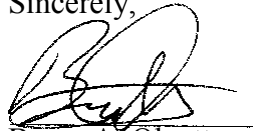
Dear Ms. Dortch:

On December 1, 2016, representatives of The Boeing Company (“Boeing”) met in separate meetings with legal advisors for various of the FCC Commissioners. Participating on behalf of the Commissioners’ offices in four separate meetings were Johanna Thomas, Brendan Carr, Erin McGrath, and Daudeline Meme, with intern, Megan Sunn accompanying Ms. Meme. Participating on behalf of Boeing were Bruce Chesley, Robert Vaughan, Ying Fera, Kim Kolb, and the undersigned.

During the meetings, the Boeing representatives provided an overview of Boeing’s recently filed application for a non-geostationary satellite orbit (“NGSO”) system operating in the Ka-band. The Boeing representatives also discussed the Commission’s Spectrum Frontiers proceeding and the potential for spectrum sharing between the Upper Microwave Flexible Use Service (“UMFUS”) and next-generation broadband satellite communications systems in the V-band. Both of these discussions tracked closely with the attached presentation materials.

Thank you for your attention to this matter. Please contact me if you have any questions.

Sincerely,



Bruce A. Olcott

Counsel to The Boeing Company

Attachments

# Boeing Ka-band NGSO System Overview

## High Altitude Inclined Constellation

Orbit Altitude: Inclined GEO  
(27,355 to 44,221 km)

Inclination  $63.4^\circ$ ,  $e=0.2$

Provides global coverage via 3 nodes  
(Americas, Europe-Africa, Asia)

Spacecraft qty: 30 to 60  
(initial deployments 10 per node)

High elevation angle ( $>40^\circ$ )

6-deg separation angle maintained  
( $\alpha$ ) when crossing GSO arc

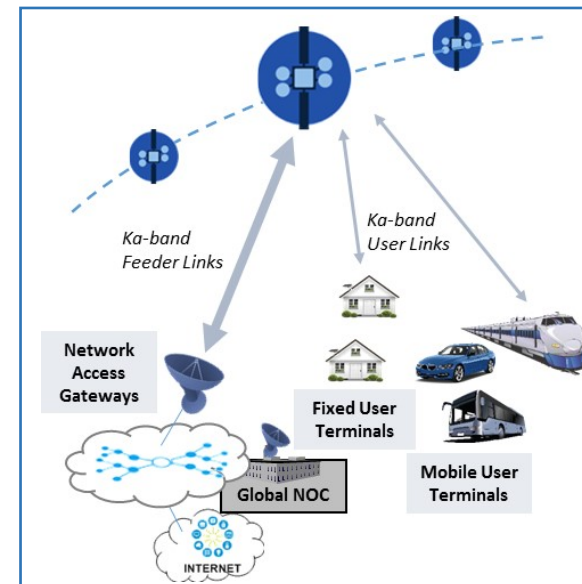
## Service Goals

Broadband data service with  
flexible wide area and narrow spot  
beam coverage

Up to 16x frequency re-use and  
additional satellite diversity

## Peak User Rates

Exceeds FCC's broadband goals  
 $>25$  Mbps Down /  $>3$  Mbps Up

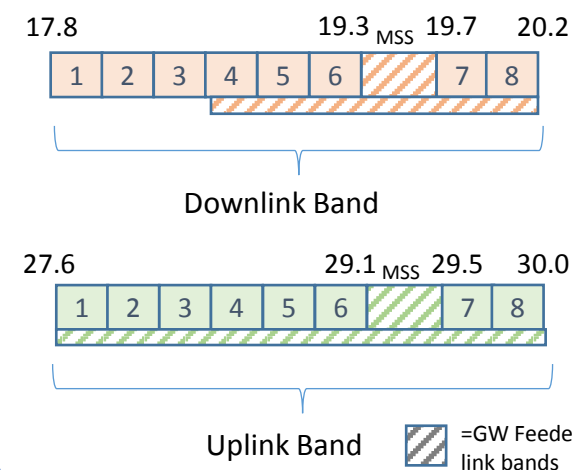


## System Design

Two-way broadband service and  
data distribution to mobile and  
fixed users

Efficiency spectrum re-use via  
flexible beam-forming technology  
and satellite diversity

Global broadband coverage with  
modest constellation size



## Frequency Plan

System uses 2.4 GHz Ka-band dual  
polarization, up and down

FSS and MSS band operations

8 user channels  $\sim 250$  MHz each

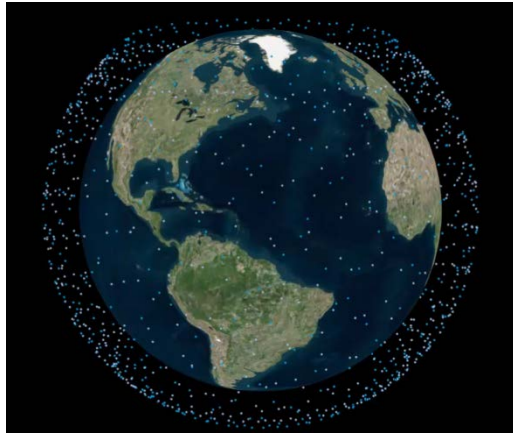
Gateways and user terminals share  
FSS uplink and downlink bands

PFD and ePFD compliant

Gateway site diversity and flexible  
payload /user terminal operations  
for spectrum sharing

**Broadband speeds and data distribution to fixed and mobile users**

# Boeing V-Band Global Broadband System

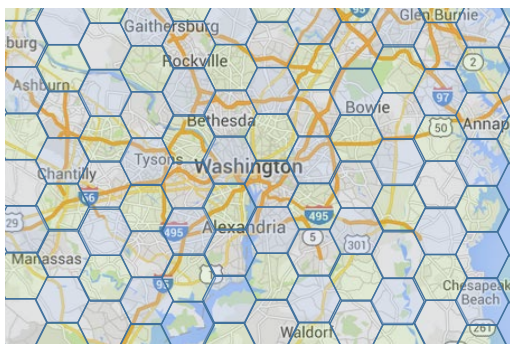


## Global Constellation

Spacecraft Qty: 1396/2956  
Orbit Altitude: ~1200 km  
Orbit Inclinations: 45°, 55° & 88°

Provides Global Coverage

8 km cells over Washington DC



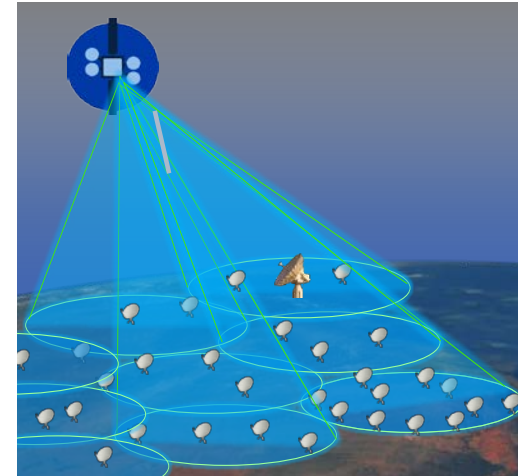
## Service Density

3-Color (Time) reuse allows for very high throughput that is competitive to serve both urban and rural areas

## Peak User Rates

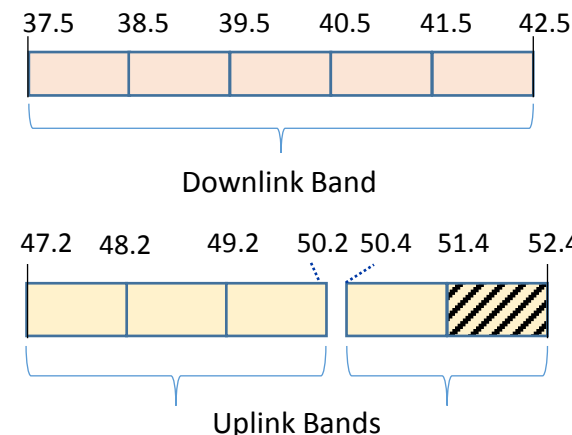
Exceeds FCC's Broadband Goals  
>25 Mbps Down / >3 Mbps Up

**Broadband speeds are available to all global users**



## System Design

Broad Coverage LEO Satellites with Flexible Beam-forming Technology  
Phased array antennas form robust links with high throughput and isolation and low side-lobe beams  
Millimeter wave technology proven and deployed in government and commercial FSS and terrestrial systems

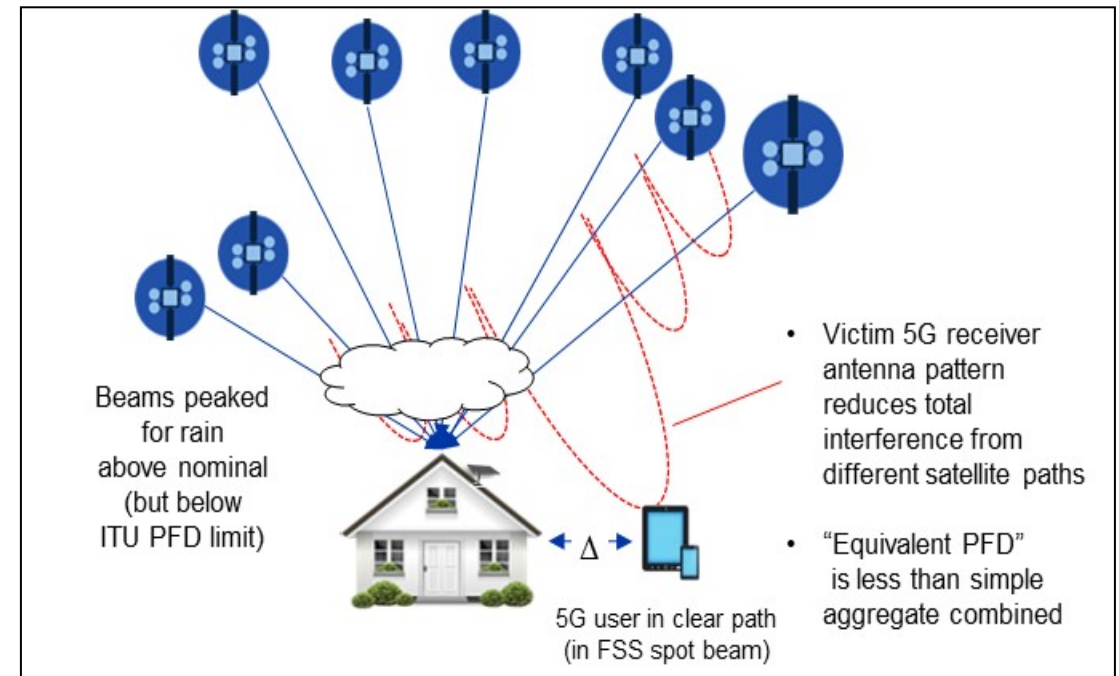


## Frequency Plan

Each Beam uses all 5 GHz, dual polarization, up and down  
Time domain division between adjacent cells  
Gateways and user terminals share uplink and downlink bands

# Broadband Satellite Downlink Requirements

- Satellite systems need access to an entire 5 GHz of paired V-band spectrum
- Boeing's sharing proposals provide UMFUS and FSS shared access to the majority of the 5 GHz of paired V-band spectrum
- Broadband forward links to end users require:
  - Full access to 40.0-42.0 GHz band
  - Opportunistic Access to 37.5-40.0 GHz band
  - Opportunistic Access to 42.0-42.5 GHz band
- Boeing's studies demonstrate aggregate satellite downlinks in the 37.5-40.0 GHz band at up to ITU PFD levels (calculated using an ePFD approach) will not harm UMFUS systems



# Use of ePFD Limits in the 37/39 GHz Band

- **Boeing proposed the use of ePFD limits to protect UMFUS in 37/39 GHz band**
  - **FCC's existing PFD rules restrict the total power transmitted by each satellite**
  - **ePFD rules restrict total power of all satellite transmissions received by UMFUS receiver**
- **ePFD rules are much more effective in managing transmissions from multiple satellites at different points in the sky in varying weather conditions**
  - **This is why the FCC maintains ePFD limits for NGSO FSS systems in the Ku-band**
- **Boeing's proposed ePFD rules would reliably limit very worst-case degradation to UMFUS receivers to negligible levels (*i.e.*, around 0.65 dB)**
- **Several parties questioned Boeing's ePFD proposal in their reply comments**
  - **Straight Path, T-Mobile, Samsung and CTIA made several errors and used incorrect assumptions regarding ePFD calculations and/or Boeing's NGSO satellite system**
- **Once corrected, analysis by other parties supports Boeing's conclusion that its NGSO system will have a negligible impact to UMFUS in 37/39 GHz band**

# Broadband Satellite Uplink Requirements

- **Satellite systems require 5 GHz of matching Gateway uplink spectrum to service forward downlinks to satellite end user terminals**
  - Boeing's Gateways can be located in rural areas and will likely affect about 0.1% of U.S. population
  - Satellite Gateway locations should be coordinated with UMFUS systems on a first-in-time basis
  - Satellite Gateways cannot be restricted to 1 or 3 per PEA or to 0.1% of population in many PEAs
- **Satellite end user terminals require 3 GHz of return uplink spectrum at 47.2-50.2 GHz**
  - Can share if UMFUS located indoors or allowed outdoors on an opportunistic secondary basis

